Research Article


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Higher education is the cornerstone of national development. With the rapid development of higher education, it puts forward requirements for the management and allocation of financial resources in colleges and universities. In order for sustainable development of colleges and universities, how to optimize the management and allocation of financial resources has become an important condition. To ensure the smooth implementation and development of various works in colleges and universities and to improve the scientific rationality of college financial budgets, this paper starts with the challenges faced by the college financial work in the new era, analyzes the problems of the college financial resource management, and proposes relevant solutions.

Method: combined with the intelligent optimization algorithm, the method used in different situations of financial configuration is introduced, and compared with different algorithms, according to the comparison results, we can get the better intelligent optimization algorithm we want and find the optimal solution among global instances.

1. Introduction

The financial resource allocation system of some colleges and universities is gradually reformed, but there are problems and difficulties in its operation efficiency and work quality. These problems indicate that we need to further optimize the management system and allocation methods [1]. In some universities, seeking to maximize the quality of the educational experience provided to students, there is a hierarchical structure in the quality of schools between different schools, with significant stratification of income and ability, and the pricing policies adopted by schools also vary [2] and adopt corresponding management of school financial resources. In the early days, UMMS responded to the changing trend of traditional funding and changed the financial structure and financial culture of the school. The school began to offer a course to change the traditional budget thinking and develop related indicators to show how resources are affected by related activities [3]. From today’s point of view, the school’s budget declaration concept should establish authority and expenditure responsibility, form authority departments, disclose budget declaration information, and participate in the declaration and supervision of all staff [4]. Under the current background, colleges and universities should establish a comprehensive budget system, guide scientific budget preparation activities, improve relevant systems and organizational structures, and reconstruct the implementation process [5]. In the background of the domestic college education system, financial management is an important part of college management. Colleges and universities should improve financial management and other related management to promote school development [6]. Similarly, literature [7] analyzed that with the increase of national financial and social capital investment in higher education, colleges and universities should optimize the allocation of resources, improve the financial management work and level of colleges and universities, and promote the high-quality development of schools. Under multi-objective conditions, choosing intelligent optimization is required for our financial management and allocation methods, so we
need optimized algorithms. Reference [8] describes the related algorithms and their practical application cases. Swarm intelligence optimization algorithms use the advantages of groups to find solutions to difficult problems [9]. For example, the optimization algorithm case [10] uses this algorithm to solve the relevant algorithm requirements, which shows that it is promising to find the optimal solution and proves that the algorithm in the literature has the property of value convergence. Today, there are many intelligent optimization algorithms for our reference. In the above literature, more or less the improvement methods of financial management in colleges and universities are given, but they are only limited to a part of financial management and configuration in colleges and universities and have not been fully implemented. They run through the entire organizational framework and only improve within the framework. The given intelligent optimization algorithm is listed at one time but not expressed by situation, or the algorithm itself is no longer suitable for the requirements of current university financial resource management and allocation. This paper will restructure the university financial resource management system from the perspective of intelligence, based on the fact that this provides intelligent optimization algorithms that seek optimal solutions for financial allocation.

2. University Financial Organization System and Intelligent Optimization Algorithm

2.1. University Financial Organization System. Pyramid organizational structure causes items to be approved layer by layer [11], lack of horizontal communication, which is not conducive to financial management activities, and the efficiency of layer approval is low. It is easy to cause lag in information transmission and information asymmetry. In the actual functional division of labor, some functional personnel do not understand the relevant project budget, which is prone to misunderstanding and affects execution. Let us take Sunshine University as an example as shown in Figure 1.

2.1.1. Optimization of University Financial Organization System. The school’s business volume and financial income have increased year by year. In the existing organizational structure, the finance department needs to invest a considerable amount of personnel to maintain a normal operation. Too many departments and levels have resulted in overlapping functions and redundant personnel resulting in wasted manpower and low efficiency. Here, we can take advantage of the decentralized features of the blockchain to promote the flattening of the organizational structure [12], streamlining departments, and compressing management. Therefore, we can set three levels: financial management level, financial service level, and financial business level, to optimize the organizational structure as shown in Figure 2.

In order to better highlight the flattening, the three major levels should be under the same framework and restrict each other.

After the departmental organization is optimized, it is the sorting and adjustment of the relevant financial personnel levels. The relationship between the superiors and employees of the college is not the relationship between the leader and the led. The superiors and employees receive tasks according to relevant task instructions and individual talents and arrange personnel at other levels. Complete tasks together, strengthen horizontal communication, and promote the enthusiasm of employees in the department. The superior is responsible for answering, guiding, and supervising.

2.2. Multiple Objective Intelligent Optimization Algorithm. After the above effective optimization of the financial organizational structure of colleges and universities, the efficiency of the financial department in managing financial-related resources has increased, the speed of multi-directional information transmission has been accelerated, the transparency of data has increased, and the problems that various functional departments have discovered and need to deal with have increased. We need to introduce multi-objective intelligent optimization algorithms to help us find the optimal solution to financial-related problems.

2.2.1. Quantum Algorithms. Different from simulated annealing, quantum annealing [13] can jump out of the local optimum by virtue of its quantum-specific effects. Many optimization problems require a mapping before they can be solved by quantum algorithms:

\[ H_p = \sum_{i=1}^{n} h_i \sigma_i^z + \sum_{i,j=1}^{n} J_{ij} \sigma_i^x \sigma_j^x. \]

Among them, \( h_i \) is the degree of offset and \( J_{ij} \) represents the degree of fit between \( i \) and \( j \).

Then, the function of quantum annealing is

\[ H(t) = H_p + \Gamma(t) \sum_{i=1}^{n} \Delta \sigma_i^x. \]

\( \Gamma \) is the field strength, similar to the temperature \( T \) in the simulated annealing function.

It can be seen that the quantum algorithm converges faster, can obtain the desired data more accurately, and is expected to reach the global optimal solution in the search target.

2.2.2. Firefly Algorithm. The above quantum algorithm is suitable for finding the solution of the problem when the problem is relatively clear, but usually in our actual financial resource management and allocation, the multi-objective problem algorithm encountered is large in scale and when the complexity is more complex it needs a group. Action to find the global ideal solution. Here, we need the firefly algorithm [14].

We assume that there are N fireflies and the search space is H dimension, then the initial space of fireflies in H space can be expressed as \( X_j = [x_{j,1}, x_{j,2}, \ldots, x_{j,n}] \).
Brightness of the 1-th firefly

\[ I_{oi} = f(x_i). \]  

Relative brightness of the 1-th firefly:

\[ I_i = I_{oi} \cdot e^{-\lambda r_{ij}}. \]  

The parameter is related to the area, and represents the distance between the target and another target firefly.

Attractiveness:

\[ \beta = \beta_o \cdot e^{-\lambda r_{ij}}. \]  

\(\beta_o\) represents the maximum attraction between fireflies.

We need to increase the range of search objects to prevent the algorithm from converging prematurely. So join \(a(\text{rand} - 1/2):\)

\[ X_i^{t+1} = X_i^t + \beta \cdot (X_j^t + X_i^t) + a(\text{rand} - \frac{1}{2}). \]  

Here, we get the firefly algorithm, which converges to obtain the best quality by moving the firefly to the brighter part. When dealing with how to optimize the management and allocation of financial resources, you can select the relevant financial resources to be processed according to different situations and conditions, substitute the algorithm, and conduct simulations to find the ideal solution for resource allocation.

3. Multiple Objective Intelligent Optimization Algorithm Improvement

3.1. Quantum Model of Intelligent Optimization Algorithm.

On the basis of the above, we can establish the intelligent optimization algorithm equation:

\[ ih \frac{\partial \psi(x,t)}{\partial t} = \left[ -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + f(x) \right] \psi(x,t). \]  

This idea has also been adopted in other algorithms of the same type [15]. But it does not realize the relationship between target and potential energy. \(\tau = it/h, \quad D = \hbar/2m:\)
\[
\frac{\partial \psi(x, \tau)}{\partial \tau} = \left[ D \frac{\partial^2}{\partial x^2} - f(x) \right] \psi(x, \tau).
\] (8)

But because the introduction of the constraints of our optimization problem destroys the unity of Green's conditions, we introduce a convergence factor, and after adjustment we finally get
\[
\frac{\partial \psi(x, \tau)}{\partial \tau} = \left[ D \frac{\partial^2}{\partial x^2} - [f(x) - E_i] \right] \psi(x, \tau).
\] (9)

For the application of financial resource management and configuration in colleges and universities, iterative operations can be designed according to the reference data to be obtained, and the specific data to be obtained in the application scenario can be calculated through the iterative function.

We want to describe the path of the target resource from \(m\) to \(n\), which is obtained by deforming the optimization algorithm equation:
\[
\psi(x, \tau) = \lim_{n \to -\infty} \int_{-\infty}^{\infty} \left( \prod_{j=0}^{n-1} dx \right) \prod_{n=1}^{n} W(x_n) P(x_n, x_{n-1}).
\] (10)

In the above formula, we have to find out the motion behavior of the target resource, and the formula related to its location and size is
\[
P(x_n, x_{n-1}) = \left( \frac{m}{2\pi h \Delta \tau} \right)^{1/2} \exp \left[ \frac{m(x_n - x_{n-1})^2}{2h \Delta \tau} \right].
\] (11)

In order to optimize the firefly algorithm, we introduce a random flight distribution:
\[
s_i = \frac{\mu}{|v|^{1/\beta}}.
\] (17)

Among them,
\[
\left( \begin{array}{c}
\mu \\
\mu \\
\mu \\
\mu \\
\end{array} \right) \sim n \left( 0, \sigma_r^2 \right)
\] (18)

Also,
\[
\sigma_r = \begin{cases} 
\Gamma \left( 1 + \frac{1}{\beta} \right) \sin (\pi \beta / 2) / \Gamma \left( (1 + \beta) / 2 \right)^{1/\beta}, & \text{if } f \left( X_i^{t+1} \right) > f \left( X_i^t \right), \\
\sigma_r = 1, & \text{else.}
\end{cases}
\] (19)

To get the probability that the target resource appears in the position of the specified scheme, we need
\[
W(x_n) = \exp \left[ -\frac{1}{n} \int \frac{f(x_n) - [E_i]}{\Delta \tau} \right].
\] (12)

Similarly, we can use a Monte Carlo method to find the expectation under
\[
\int_a^b h(x) dx = \int_a^b f(x) p(x) dx = E_p[f(x)].
\] (13)

Then, the density function of the target is
\[
P(x_1 \ldots x_n) = \prod_{n=1}^{n} P(x_n, x_{n-1}).
\] (14)

The function is
\[
f(x_1 \ldots x_n) = \prod_{n=1}^{n} W(x_n),
\]
\[
\psi(x, \tau) = E_{p(x)} \left[ f(x) \right] \approx \frac{1}{n} \sum_{i=1}^{n} \psi(x_0, 0) \prod_{n=1}^{n} W(x_n).
\] (15)

The process of changing the target can be obtained intuitively.

3.2. Improved Firefly Algorithm. The traditional firefly algorithm may have problems such as weak local discovery ability. We improved the individual and the direction of its distribution:
\[
X_i^{t+1} = \begin{cases} 
X_i^t, & \text{if } f \left( X_i^{t+1} \right) > f \left( X_i^t \right), \\
X_i^t + \beta \cdot (X_j^t - X_i^t) + \alpha \left( \text{rand} - \frac{1}{2} \right), & \text{else.}
\end{cases}
\] (16)

\[
X_i^{t+1} = X_i^t + \beta \cdot (X_j^t - X_i^t)
\] (20)

\[
+ \alpha \cdot \text{sign} \left( \text{rand} - \frac{1}{2} \right) \mu \cdot \text{Levy} \sim \frac{\mu}{|v|^{1/\beta}}.
\]

After we introduce the random flight distribution, the ability of the firefly algorithm to search for an ideal solution globally is improved, but the accuracy may be reduced when the target acquisition solution is carried out in a specific range. To solve this problem, we obtain a good resource factor which is
\[
X_i^{\text{best}} = X_i^t, \text{ if } f \left( X_i^{t+1} \right) \leq f \left( X_i^t \right), \forall i \in \{1, 2, \ldots, n\}.
\] (21)

Then, we overlap the positions of good individuals and nongood individuals and then compare the values before and after the overlap to select better individuals:
Finally, combined with the above formula, we consider the time situation \( x(1) \) in the best case of the time situation considered by financial resources:

\[
T_{\text{iteration}} \times \left( o\left( (D + f(D) + 1)n + x_1 \right) + o(n^2) \right) + o \left( I(D) \times n \right) + o(1) + o(1). \tag{23}
\]

The worst situation:

\[
T_{\text{iteration}} \times \left( o\left( (D + f(D) + 1)n + x_1 \right) + o(n^2) \right) + o \left( I(D + x_2) \times n \right) + o\left( 1 + g(n) \right) + o(1). \tag{24}
\]

Although we optimize the firefly algorithm to the end, the complexity of its equations increases, but it can quickly and effectively find the optimal configuration scheme we want in dealing with the complex and huge financial management configuration applications in colleges and universities.

4. Experiment

4.1. Comparison of the Actual Ability of Various Algorithms to Seek the Optimal Financial Solution. Considering that most of the algorithms we face in the processing of financial resources are relatively large and difficult, we set up 20 schemes related to the management and allocation of financial resources in colleges and universities, give the target financial resources, and then set the resource parameters into the improved firefly algorithm and other swarm intelligence optimization algorithms, and then compare the optimal choices of the six algorithms in the experiment for these 20 schemes.

We can make initial settings for a variety of algorithms as shown in Table 1.

Table 1: Algorithm parameters.

<table>
<thead>
<tr>
<th>Model</th>
<th>Parameter setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEEFA</td>
<td>( \alpha = 0.1, \beta_0 = 1, \gamma = 0.002, I_{\text{threshold}} = 0.1 )</td>
</tr>
<tr>
<td>PSO</td>
<td>( C_1 = 1.8, C_2 = 1.8, w = 0.8, v_{\text{max}} = 1, v_{\text{min}} = -1 )</td>
</tr>
<tr>
<td>GA</td>
<td>( p_m = 0.01, p_c = 0.8 )</td>
</tr>
<tr>
<td>ABC</td>
<td>( l_{\text{limit}} = N \cdot D )</td>
</tr>
<tr>
<td>FA</td>
<td>( \alpha = 0.1, \beta_0 = 1, \gamma = 1 )</td>
</tr>
<tr>
<td>LFFA</td>
<td>( \alpha = 0.1, \beta_0 = 1, \gamma = 1 )</td>
</tr>
</tbody>
</table>

4.2. Optimal Solutions of Different Algorithms to the Scheme. The choices of algorithms are as shown in Figures 3–8.

Figure 9 shows a bar graph that can more intuitively show the superiority of the optimized firefly algorithm.

It can be seen that after incorporating the random flight mechanism and good individuals, the optimized algorithm (LEEFA) converges significantly faster than other algorithms in more than 2,000 uninterrupted iterations and can avoid falling into the local solution like other algorithms. Youzhi-hong found the global best financial solution. Therefore, in the face of complex and huge plan decisions in the future, choosing the optimized firefly algorithm is more conducive to us than choosing the optimal one among many financial resource decision-making plans in the future.

Comparison of different search targets, convergence accuracy under different parameters, etc. However, it is sufficient to select a suitable intelligent algorithm under this experiment.

4.3. Performance Comparison after Optimization of Resource Allocation in Colleges and Universities

4.3.1. Optimization Scheme. We apply the selected firefly intelligent optimization algorithm. Taking Sunshine University as an example, on the basis of the optimization of the financial organization structure of Sunshine University, we use the algorithm to select an optimal financial reimbursement method to prove that the optimization algorithm is effective for multi-objective financial management, and
the solution of the ideal scheme of the configuration method is shown in Figures 10 and 11.

The “Network Image Comparison” logo from the “Generate Order Number” link to the “Project Leader’s Online Approval” link, and add the “Enter Online Banking Payment” logo from the “Review” link to the “Settlement and Payment” link.

Simplify the application process. The applicant only needs to upload the bill through the network, and then automatically generate the order number. The approval and accounting are integrated, and the automatic review is carried out through the comparison of network electronic images, which reduces the possibility of forgery and alteration of bills and reduces the malicious use of financial resources. Probability upon entering the payment state, each payment of funds will be recorded in the entire link chain. If relevant departments want to obtain payment vouchers, they can also download relevant voucher records from the internet and print them. Prevent the movement of non-compliant funds. In the final filing process, the relevant vouchers will be stored in the school’s intranet, and relevant personnel can refer to them at any time when necessary, but the access records will be recorded.

4.3.2. Performance Comparison. We compare the processing performance of the two schemes with 50 people participating in financial reimbursement as a reference as shown in Figure 12.

It can be clearly seen from the picture that the number of participants in the process is also increasing rapidly in the traditional financial reimbursement process as the number of reimbursements increases. Because in the traditional reimbursement process, reimbursement personnel need to deliver the sorted bills to the reimbursement center. The staff of the reimbursement center will effectively distribute the documents due to the increase of reimbursement documents. Each type of bills and documents needs to be sorted by corresponding staff, thereby increasing the number of personnel involved in the process. The same is true for the increase in the number of trial and induction personnel in the process. In the algorithm-optimized process, the corresponding trial sections have been electronically integrated, and the progressive reimbursement process structure has been compressed to increase efficiency and reduce the number of personnel required.

The above histogram can clearly reflect the change in response time between the traditional reimbursement process and the optimized reimbursement process. The traditional reimbursement process adopts the classic layer by layer transmission of information. After the reimbursement personnel hand in the corresponding bills, the reviewer manually scans and uploads them with an electronic scanner and then confirms them layer by layer. The existence of information difference between them leads to the need to look for integration and confirm with the information in the process of information transmission in the network. Therefore, in the traditional reimbursement process, the network response time is longer and the number of
Reimbursement officer provides bills

Book online, print voucher

Signature and seal of the project leader

Deliver the bill to the billing hall

Cashier payment

Original ticket binding archive

Internal audit

Financial Management Office

Data Analysis

Figure 10: Sunshine University reimbursement financial process.

Apply

approval

accounting

pay

manage

collect bills

Upload network

Generate a tracking number

Billing accounting

Not returned

electronic image recording

Electronic filing

Not passed

Financial audit

Online inquiry

Project leader online approval

Settlement payment

Review

Figure 11: The optimized financial reimbursement process of Sunshine University. The payment optimization flow chart, the budget management optimization flow chart, etc.

The number of participants

The number of reimbursements

Optimized financial reimbursement process

Traditional financial reimbursement process

Figure 12: Participant comparison chart.
responses is higher. After the optimization of the intelligent algorithm, our process has been simplified a lot, and the electronic integrated scanning and auditing is adopted as shown in Figure 13.

In the traditional financial reimbursement process, the time required at the end of the reimbursement process, that is, the final filing increases as the number of reimbursed persons increases. The reimbursement process without optimization adopts the form of data submission layer by layer. The core element is the time arrangement of the management personnel, which has too many subjective elements. Therefore, the actual time to finally obtain the bill voucher file will increase due to the increase of reimbursement materials. The most likely consequence is to delay the timeliness of financial data analysis. In the optimized process plan, most of the processes adopt flat integrated design and network intelligent processing. Therefore, it only takes a short time from the submission of data by reimbursement personnel to the final data entry into the file, which ensures the timeliness of financial analysis to the greatest extent as shown in Figure 14.

There is a lack of combining actual cases, and you can also increase your own practice after selecting a plan to reflect whether the plan is optimal.

When the above is a single reimbursement process, it can be clearly seen that the financial reimbursement process method selected by our intelligent algorithm has obvious optimization in terms of time, number of participants, and process steps compared with the previous process. From the above process, the overall network response processing time has changed from 120 seconds to 10 seconds after optimization, not only because of the advantages brought by blockchain but also because of the simplified process and optimized overall network response time. The overall process days have also changed from the original three days to only one day. The optimized process integrates the document approval, review, and other processes, and the entire process of electronic inspection and verification in addition
to approval greatly reduces the number of process days and the overall process. The number of people needed is the number of responses for the network to process the agent, and the reduction of the number of responses is beneficial to the processing of other situations and reduces the waste of financial resources as shown in Figure 15.

It should also be compared with the optimization process selected by other algorithms, such as the particle swarm algorithm and the financial reimbursement process plan selected by the gray wolf algorithm.

5. Conclusion

In order to explore the method of optimizing the management and allocation of financial resources in colleges and universities oriented to multi-objective intelligence, this paper analyzes that the current financial organization system of Sunshine University is a classic pyramid model, which is not conducive to the exchange of information within the financial organization and the motivation of employees. Therefore, an improvement plan is proposed, using the blockchain technology as the prototype, using its core idea of decentralization, the design flattens the financial organization, changes the original hierarchical relationship, strengthens horizontal communication, and increases employee satisfaction. On this basis, we have the conditions to efficiently select a good optimization algorithm for scheme selection. When choosing an intelligent optimization algorithm, we consider the number of algorithms faced by multi-objective method selection and the complexity of the problem. In general, we choose an intelligently optimized quantum algorithm to help us choose the optimal solution. When the algorithm is complex and the algorithm is huge, we choose the optimized firefly algorithm. In the experiment, after comparing with other algorithms, the performance of this algorithm is significantly better than other algorithms, which is the ideal algorithm we want. Then we use this algorithm to optimize the financial resource management and allocation methods. For example, in the experimental example, we intelligently optimize the reimbursement financial process, and the optimized process method has made great progress compared with the previous one.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References


